

REMARKS/ARGUMENTS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 3-7, 10-17 and 21-25 are pending in this application.

Claims 3 and 10 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Sasaki (U.S. '623) in view of Akhtar (U.S. '139) and Vleet (U.S. '803). Applicant traverses this rejection.

In order to establish *prima facie* case of obviousness, all of the claim limitations must be taught or suggested by the prior art. The combination of Sasaki, Akhtar and Vleet fails to teach or suggest all of the claim limitations. For example, the combination of Sasaki, Akhtar and Vleet fails to teach or suggest “processing the data in the received plurality of data files by aggregating those of the received data files having a common predetermined expiry time to create a plurality of aggregated compressed data files, and...wherein the compression and aggregation technique applied to the data is a Bloom filter process, and wherein each individual aggregated compressed data file has a predetermined expiry time which is equal to the common predetermined expiry time of the received data files included in that individual aggregated compressed data file, and wherein the aggregated compressed data files are only forwarded if they have not exceeded their predetermined expiry time,” as required by independent claim 3 and its dependents. Similar comments apply to independent claim 10 and its dependents.

Although the Office Action suggests that Bloom filters and compressed aggregate messages are known, Applicant submits that it would not be practical to simply generate a single Bloom filter for all the event reports, as the reports cannot subsequently be individually removed, and the content of the message would just grow continuously. The inventions of the independent

claims goes beyond the teachings of the combination of Sasaki, Akhtar and Vleet to solve a problem in a manner not suggested by any of the prior art references. For example and as evident by the above-quoted claim limitations, the invention of claim 3 requires aggregating only those received data files having a common predetermined expiry time to create a plurality of aggregated compressed data files, wherein the compression and aggregation technique applied to the data is a Bloom filter process. This allows Bloom vectors to be combined, provided that they have the same (or common) expiry time. Reports with later expiry times may be carried in separate Bloom filter messages.

In more detail, the inventions of independent claims (e.g., through the above-noted claim limitations) create a separate Bloom filter for each expiry time, thus only combining data files with the same (or common) expiry time into any one Bloom filter, which can be deleted on expiry of (all) its contents. This can be done without losing any data files with later times as they are carried in separate messages (i.e., it does not prevent Bloom vectors being combined, provided that they have the same expiry time). This use of a separate Bloom filter for each aggregate data file, depending on the expiry times of the data files it carries, is not taught or suggested by any of the cited combinations of prior art under 35 U.S.C. §103.

Akhtar discloses a system for disseminating data over a communications network, specifically one operating according to the Internet Protocol. Akhtar has apparently been cited for use of an expiry time for each data item to avoid the problem of “stale” data remaining in a system indefinitely (see column 7, lines 44-57). However, Akhtar fails to teach or suggest that the “gatekeepers” 100 process the data they handle in any way analogous to the operation of the claimed relays.

Sasaki has been apparently been cited as an example of compression and expansion in the context of data transmission and reception. In fact, Sasaki is primarily concerned with detecting whether the transmitted data is complete: compression is only mentioned in passing to indicate that Sasaki's system can work with compressed data. Sasaki specifically mentions that the data can be expanded again (see, e.g., column 2 lines 49-52). Expansion allows data in the compressed file to be extracted, sorted, deleted, or selected for further transmission.

However, this is not the case for Bloom filters. Accordingly, whatever compression technique Sasaki is using, it cannot be a Bloom filter. The reference to data integration appears to relate to the re-combination of data from the original file and the volume comparison data relating to that file. There is no suggestion of forwarding such integrated data elsewhere, as claimed. There also is no teaching or suggestion for receiving the data to be integrated (aggregated) from different sources, as required by both claims 10 and 17.

Deletion of expired data is the only processing suggested by the combination of Akhtar and Sasaki: there is no disclosure in either reference of aggregating data from different sources for onward transmission as claimed, nor indeed of any other processing.

Vleet does not bridge the gap between the Examiner's proposed Akhtar/ Sasaki combination and the present claims. As discussed in Applicant's specification, Bloom filters can be used to aggregate data. Indeed, Vleet describes a typical application of such constructs. Bloom filters have certain advantages in event recording, for example because of the small amount of processing required to add an additional data item to an existing data file. It is also relatively easy to identify whether an individual data item is, or is not, present in the file. The filters are also efficient in avoiding the creation of duplicate data items.

However, it is not generally possible to delete individual items from an existing Bloom Filter file.

The Office Action cites Vleet to indicate that Bloom filters and compressed aggregate messages are known. However, Vleet operates in a single reporting node – data is collected and reported to a central server which does all the processing. There is no distributed system with reports disseminated throughout the system as claimed. Vleet therefore has no need to combine or expand messages, and in particular has no need to delete data from an existing message.

Vleet's server 32 processes the data generated in respect of an individual user by generating a Bloom filter. However, this operation, and the subsequent use of the filters so generated, is entirely internal to the server. The medium by which the server is connected to the individual users is not specified, and the Bloom filters are not transmitted over that medium in any case. Paragraphs 55 and 72, and Figure 2 indicate that Bloom filters may be exchanged between the cache layer 42 and the storage layer 46, but these are both part of the event history server 32 (see Figure 1). It is not suggested that any such data is transmitted over the network. Paragraph 76 discusses the consequences of Bloom filters reaching capacity: the inability to store any further events is a consequence of it being impossible to delete events already recorded without corrupting the rest of the data. That is, storing more data requires that the filter be replaced by a larger one – individual data items cannot be purged from the system. The Bloom filter can only be purged in its entirety (see paragraph 75).

The combination of Sasaki, Akhtar and Vleet does not relate to a “decentralised” network with nodes that can themselves process data. The Office Action suggests combining these references by using Vleet's Bloom filters as a means of compressing the data in the hypothetical Sasaki/Akhtar system. Even assuming *arguendo* that one skilled in art would think

of combining these three particular teachings, from fields that are not closely related, at least two further steps (which are non-obvious) are required in order to arrive at the invention.

The first extra step is the idea of using Bloom filter data for transmission over a network from one relay device to another. None the combination fails to teach or suggest this feature. Instead, the Bloom filter data is only disclosed (by Vleet) as part of an internal processing function. This has the advantage of relatively simple processing, and in particular duplicate reports arriving at a node by different routes will automatically be merged, as they will have the same value in each of the incoming messages.

Even if this idea suggested itself to one skilled in the art, it would be immediately apparent to one skilled in the art that such a combination would not work if the data includes different expiry times, because it is a characteristic of Bloom filters that individual data items cannot be deleted from an existing file (see pages 5-6 of the original specification). It would therefore not be practical to simply generate a single Bloom filter for all the event reports, as the reports cannot subsequently be individually removed, and the content of the message would just grow continuously until the filter reached capacity, at which point it would be of no further use. However, purging the filter would result in the loss of all data, including some very recent data.

In the invention of independent claims, separate Bloom filters for data with different expiry times, overcome this problem. This use of a separate compressed data file for each different expiry time is a novel solution to the problem. Accordingly, the three-way combination of Sasaki, Akhtar and Vleet does not does not teach or suggest “processing the data in the received plurality of data files by aggregating those of the received data files having a common predetermined expiry time to create a plurality of aggregated compressed data files...wherein the compression and aggregation technique applied to the data is a Bloom filter process (emphasis

added)” as required by claim 3 or “processing the data in the received plurality of data files by aggregating those of the received data files having a common predetermined expiry time to create a plurality of aggregated compressed data files...wherein the relay device has a configuration to handle the data in the form of Bloom filters (emphasis added)” as required by claim 10.

The invention of the independent claims therefore goes beyond the teachings of three-way combination of Sasaki, Akhtar and Vleet to solve the above noted problem in a manner not suggested by any of the references. In particular, separate Bloom filter is created for each expiry time, thus only combining reports with the same expiry time into any one Bloom filter, which can then be deleted in its entirety on expiry of (all) its contents without also losing more recent data. Reports with later expiry times are carried in separate Bloom filter messages. This nevertheless allows Bloom vectors to be combined, provided that they have the same expiry time.

Claims 17, 21 and 22 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over the four-way combination of Van Renesse in view of Sasaki, Akhtar and Vleet. Claims 5-7 and 13-16 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over over the four-way combination of Sasaki, Akhtar and Vleet, and further in view of Van Renesse.

The combination of Sasaki, Akhtar, Vleet and Van Renesse fails to teach or suggest “the servers having means to aggregate compressed data messages having a common predetermined expiry time and being received from one or more other servers to create one or more compressed Bloom filter aggregate data files, and to broadcast the compressed aggregate data file to one or more of the other servers...the servers have means to modify the aggregate data files they

receive before broadcasting them, wherein each individual aggregate Bloom filter data file has a predetermined expiry time which is equal to the common predetermined expiry time of the aggregate compressed data messages comprising the Bloom filter data file, the servers have means for forwarding only the Bloom filter data files that have not exceeded their predetermined expiry times, using an epidemic dissemination process,” as required by independent claim 17 and its dependents.

The combination of Sasaki, Akhtar and Vleet is discussed above with respect to claims 3 and 10. Similar comments apply to claim 17. Van Renesse (the fourth reference) fails to resolve the above-described deficiencies.

Van Renesse discloses a “gossiping” system which uses version numbers in data to determine which data is the most up to date. However, Van Renesse makes no mention of deleting old messages (rather than forwarding them). Van Renesse discusses a very simple aggregation of data (col. 6 lines 21-26), but this comprises merely the over-writing of superseded data – there is no compression. Accordingly, Van Renesse discloses a “time stamping” function in a “gossip”-type network.

Claims 4, 11 and 12 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Sasaki, Akhtar and Vleet, and further in view of Yosef (U.S. ‘682). Claims 23 and 24 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Sasaki, Akhtar and Vleet, and further in view of Vardakas (U.S. ‘187, previously cited). Claim 25 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Van Renesse, Sasaki, Akhtar and Vleet, and further in view of Vardakas. With respect to these dependent claims, none of this addition references (Yosef, Vardakas and/or Van Renesse) resolves the

NEKOVEE, et al.
Appl. No. 10/594,670
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above described deficiencies of cited art applied against each of their respective base independent claims.

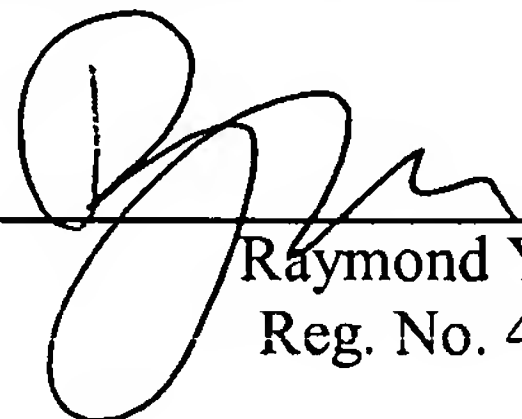
Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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